الجمهورية الجزائرية الديمقراطية الشعبية
People's Democratic Republic of Algeria

Ministry Of Higher Education
And Scientific Research
National School of Cybersecurity

وزارة التعليم العالي
و البحث العلمي
المدرسة الوطنية العليا في الأمن السيبراني

Exam

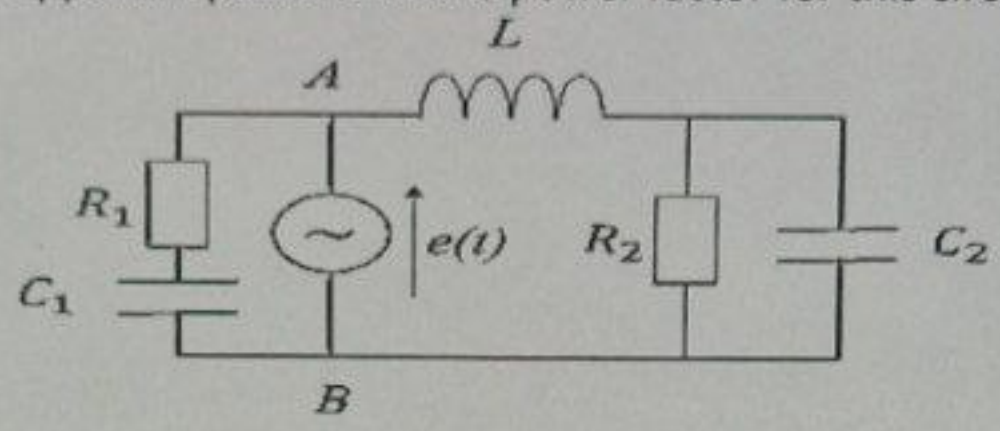
Level: 1st Year
Material: Electricity

Date: Monday 13/01/2025
Duration: 2h

Exercise1: (7pts)

In the network shown in figure, the voltage source, with zero internal impedance, delivers an electromotive force of $e(t) = E\sqrt{2}\cos(\omega t)$ with $E = 1V$ and $\omega = 4\,rad/s$, L=0.05 H, R_1=R_2=2Ω and C_1=C_2=0.125 F.

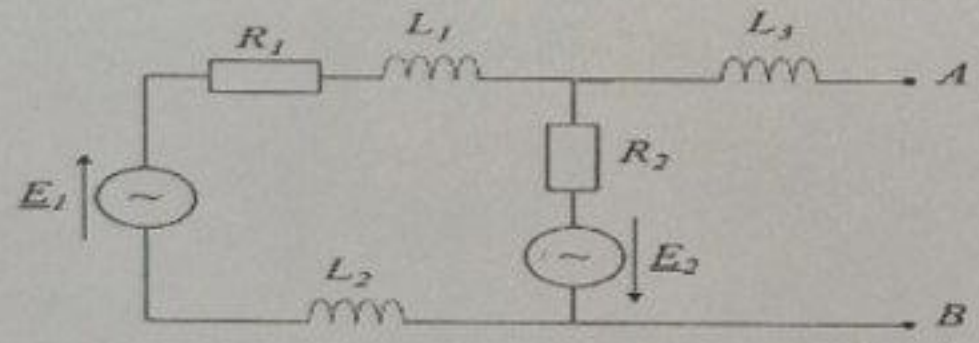
1- Calculate the impedances of the reactive elements.
2- Calculate the complex admittance of the circuit (R_2, C_2) and the complex impedance of the circuit (R_1,C_1).
3- Calculate the equivalent complex admittance of the circuit, and determine the magnitude and phase of the equivalent admittance. *Give details of the intermediate calculations.*
4- Deduce the complex value of the current delivered by the source and its instantaneous expression.
5- Calculate the active, reactive, apparent power and the power factor for this circuit.



Exercise2: (8 pts)

1- Determine the Thevenin equivalent circuit (E_{th}, Z_{th}) corresponding to the active network below between points A and B.
2- A capacitor C is connected between A and B, such that $\frac{1}{C\omega} = 2\Omega$, determine the current flowing through this capacitor.
3- Deduce the Norton equivalent generator (I_N, Z_N).

Given: $L_1\omega = 16\Omega, L_2\omega = 4\Omega, L_3\omega = 5\Omega, R_1 = R_2 = 10\Omega, \underline{E_1} = 10V\angle 0^\circ, \underline{E_2} = 10V\angle 90^\circ$



Exercise2: (5 pts)

1- Find out if there is a value of C to reach resonance at $f_0 = 2500/\pi\ Hz$
$R1 = 8\Omega$, $R2 = 8.34\ \Omega$ and $ZL = j\,8\ [\Omega]$ (circuit in fig a)

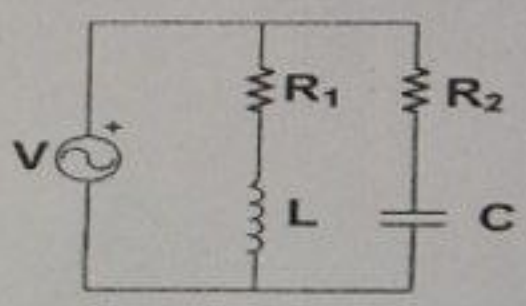


Fig a

2- Determine the resonance frequency of the circuit (see fig b) and calculate the value of current at the resonance. **Given** : $V_m = 20V$

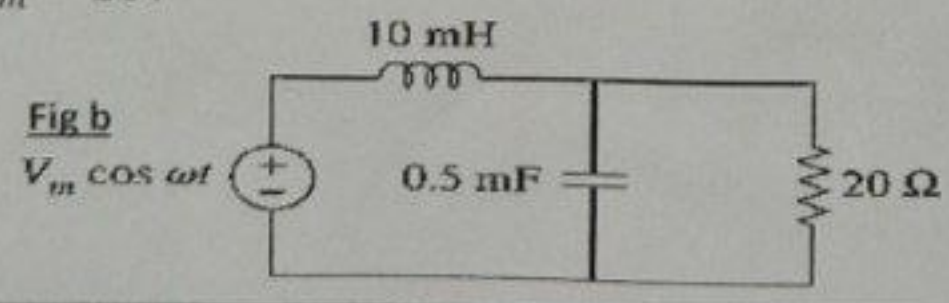


Fig b
$V_m \cos \omega t$

$2\pi f = 0$
$\delta = 0$